

Aspectos Históricos, Políticos e Culturais da Educação Brasileira

3



*Marcelo Máximo Purificação
Maria Teresa Ribeiro Pessoa
Ivonete Barreto de Amorim
(Organizadores)*



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APRESENTAÇÃO

Prezados leitores, aqui está o resultado de um trabalho feito em várias mãos, que envolve estudantes e pesquisadores de vários contextos do Brasil. Do lado de cá, na organização, professores com experiências e trajetórias diferentes usufruindo da confiança que receberam da Atena Editora, organizaram em 3 volumes, com dois eixos temáticos cada um, os 71 textos que culminam na Coletânea “Aspectos Históricos, Políticos e Culturais da Educação Brasileira”.

Uma temática atual e necessária, pois, coloca no centro da discussão científica a educação e seus atores, adornando, um diálogo que perpassa pelos aspectos históricos, políticos e culturais. Nesse cenário (educacional), novos e velhos problemas se encontram, e, por isso, se torna um cenário carente de políticas públicas educacionais eficazes. Socializar resultados de experiências e investigações que foram desenvolvidos muitas das vezes em contextos educacionais, primando pela resolução de problemas sociais de ordem diversas, é primordial.

O volume 3 da Coletânea “Aspectos Históricos, Políticos e Culturais da Educação Brasileira”, é constituído de 23 textos, organizados em dois eixos temáticos por onde perpassam temas, que para nós da educação, nos são caros, tais como: aprendizagem, cidadania, ensino, escola, formação de professores, políticas públicas, pós-graduação, privatização, teorias do currículo, entre outros. Diante o exposto, percebe-se que temos aí, temas que são propulsores para uma boa reflexão. A tod@s, uma boa leitura.

Marcelo Máximo Purificação
Maria Teresa Ribeiro Pessoa
Ivonete Barreto de Amorim

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THE REI MAGOS FORTRESS. BRAZIL. - AN ARCHAEOLOGICAL STUDY OF A SIXTEENTH CENTURY FORTIFICATION

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ABSTRACT: The Fort of the Reis Magos in Natal dates from the Sixteenth Century, one of the few built in stone and lime in this period in Brazil. Started in 1597, its installation aimed to prevent access to the river Potengy where French have settled for more than thirty years. Anticipating the planned restoration works, the Institute of Historical Heritage and I National artistic – IPHAN-sponsored the realization of an archaeological research in that fort, which responded to the specific questions formulated. The tracing of the fort, with high walls, almost vertical, reflects a time of transition in the design of fortifications. However, inconsistencies were observed between the guidelines of its tracing

and the execution of the fort. Among them, some concerned the defensive question itself, others to the logistical question. The archaeological record proved to be a safe source to know how much of the first structures was altered in the current fort.

KEYWORDS: Military archaeology,
Fortifications, Historical Archaeology,
Archaeology and Restoration.

O FORTE DOS REIS MAGOS, EM NATAL RIO GRANDE DO NORTE, BRASIL - ARQUEOLOGIA DE UM FORTE QUINHENTISTA QUE CHEGOU AOS NOSSOS DIAS

RESUMO: O Forte dos Reis Magos, em Natal é um forte quinhentista, um dos poucos construídos em pedra e cal neste período, no Brasil. Iniciado em 1597, sua instalação visava impedir o acesso ao Rio Potengy onde franceses se estabeleceram durante mais de trinta anos. Antecipando-se às obras de restauração programadas, o Instituto do Patrimônio Histórico e I Artístico Nacional – IPHAN - patrocinou a realização de uma pesquisa arqueológica naquele forte, que respondeu às questões específicas formuladas. O traçado do forte, com

altas muralhas, quase verticais, reflete uma época de transição no desenho de fortificações. Todavia observou-se inconsistências entre as diretrizes de seu traçado e a execução do forte. Dentre elas, algumas diziam respeito à questão defensiva propriamente dita, outras à questão logística. O registro arqueológico mostrou-se uma fonte segura para se conhecer o quanto das primeiras estruturas foi alterado no forte atual.

PALAVRAS - CHAVE: Arqueologia Militar; Fortificação; Arqueologia Histórica; Arquitetura Militar; Arqueologia e Restauração.

INTRODUCTION

The Rei Magos Fortress, in Natal, is a sixteenth century fortress one of the few built in stone and chalk of this period in Brazil. Although relatively well preserved, the restorations performed in the past raised issues related to the solutions implemented. The restoration schedule was anticipated by the Instituto do Patrimônio Histórico e Artístico Nacional IPHAN – National Artistic and Historic Heritage Institute – IPHAN. IPHAN requested and sponsored an archaeological research in the fortress. The research aimed at specific matters of the restoration to be performed. Other issues were not directly linked to the restoration itself but focused in understanding the day to day activities in the fortress and incorporated to the archaeological research.



Figura 1 - The Rei Magos Fortress, seen from the reefs, at low tide.

The decision to build the Reis Magos Fortress was to protect the access to the Potengy river bar (O Rio Grande – The Big River), where the French and their allies the Potiguar Indians had been established and remained over thirty years until they were definitely ousted by the Portuguese. The building of the fortress commenced in 1597 and throughout the centuries the fortress has been submitted to successive renovations.

The location chosen was a large platform sitting on the reefs alongside the coast

contiguous to the bar giving access to the river. At a small distance upstream, there was a village also of the end of the Sixteenth century, with a port that required protection.

The fortress lying on the reefs during high tide is hit by the waters of the Atlantic Ocean and access is only possible by ship. The vessels had to be small gauged ships able to reach the coast protected by the reef wall. From this viewpoint the fortress was well protected from enemies coming from the sea.

For ships attempting to assault the fortress, landing, or even combat on the reef wall facing the open sea would prove very difficult. On the other hand, on the coast, some hundred meters south, there was a concern for the fortress builders: relatively high sand dunes, an obstacle at a distance vulnerable to artillery. If the dune was to be taken, enemy field artillery could effectively damage the fortress. Two courses of action could be used by the defenders: to build their own defenses on the dunes, or to remove the dunes. They also thought of building a blockhouse but ended not doing it. Nevertheless, during the fortress' constructions they probably did try to reduce the dunes.

The fortress was built in stone on the reefs with foundations below sea level; and walls built in stone with sand filled ramparts. The sand was transported from the dunes. This was disclosed by archaeological excavations in all of the rooms and in the courtyard. Actually, the volume of sand moved was considerable, but it did not manage to reduce the dunes, constantly fed by the almost continuous winds of the location.

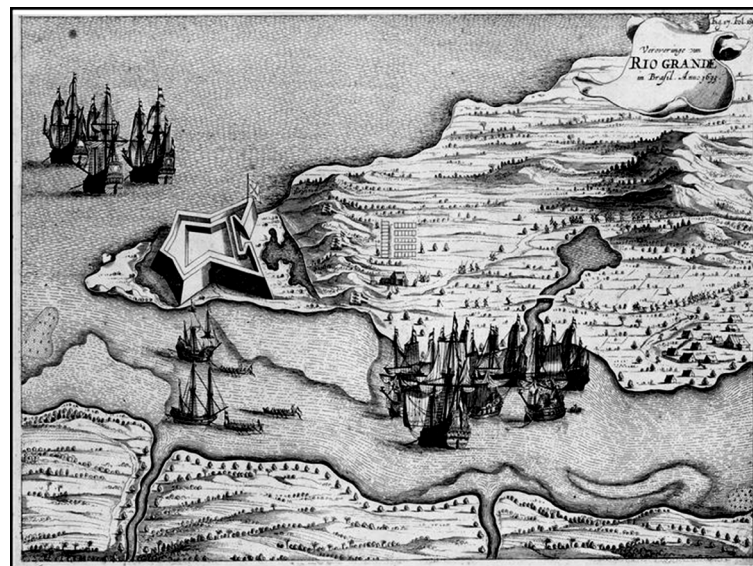


Figure 2 -This iconography depicts the dunes facing the fortress.- Commelyn, 1650 ca. Veroveringe van Rio Grande in Brazil. Year of 1633. 15 x 11,5 inches.

Up to the Nineteenth Century the fortress maintained its principal defense function, although the concepts and the weapons had changed. As a fortress and as a military post, the Reis Magos Fortress remained faithful to its roots. Unarmed since the Nineteenth Century, the construction is still used for security purposes; a lighthouse was actually built to orient navigation. The fortress was used during the First World War where it held the

2nd Temporary Coast Artillery (1916). The changes of strategic concepts, of weaponry and use, had required renovation of the fortress. There are no apparent signs of the blockhouse that preceded its construction and probably served as support and security to the construction of the fortress. The Reis Magos Fortress building design was credited to the Jesuit priest Padre Gaspar Samperes (or Gaspar S. Peres) and construction was supervised by Frias de Mesquita. The walls were high, almost vertical, reflecting a transition in fortifications design. However, there is an inconsistency between the design's guidelines, the recommendations of the engineers who supervised the construction progress and the construction itself. Know how gaps of the Seventeenth Century legacy in the fortress and its present features attest to it. In addition to occasional texts descriptions, old iconography is the first step in assessing the transformation taking place. Archaeological records are therefore, one of the most reliable sources disclosing the original Rei Magos Fortress and the extent of change impacting the fortress and resulting in its present state.

Historically, the cultural heritage of the Rei Magos Fortress is not restricted to the legacy held within its walls. Part of this cultural heritage, forged by different peoples, collect values of the day to day life of that period, history not registered in texts, but preserved exclusively by archaeological evidence, embedded in the soil. History is difficult to retrieve due the many interventions made. This heritage, notwithstanding being legally protected, has been gradually altered, unconsciously dilapidated by changes to accommodate use and by conservation work, both major and minor in the fortress and its surroundings. Restoration work and utilization adequacy are indispensable in terms of current society standards to allow for adequate use and to secure sustainability. But, restoration work is a critical event for it must preserve the material proof the History within its walls, because actions performed there, will necessarily result in the destruction of part of the archaeological records.

ASPECTS RECORDED BY ARCHAEOLOGY

Archaeological research planning consisted of text and iconographic sources in the documentation studied, deep excavations and interventions performed in the walls and abodes. Geoarchaeologic interventions were initiated with the excavations and continued as an interpretation and final conclusion tool.

The comparison of texts and design to the current state of the fortress enabled the identification of change and intervention chronology. Structural analysis were performed, not only of the remains still standing but of the ones disclosed by archaeological research, with different aspects considered: in the first place the materials employed, which included the material used to build the walls (stone, bricks, etc.) as well as consolidating materials (argyle, chalk based mortar, cement, etc.). The sources of the materials, the technology employed in the building and the quality of labor were assessed.

Construction materials are not the best method of identifying building chronology due to the continuing reuse practices throughout the centuries especially in the periods when they were harder to come by.

The presence of Dutch bricks (small yellow bricks) could represent the key to distinguish both Dutch and Portuguese buildings. Nevertheless, two reasons appear to question the use of this criterion for such purpose.

- a. Prior experience in historical archaeological sites in Pernambuco, led to the observation of bricks imported from Holland, used as flooring (as in the contiguous room to the Mikvê of the Kahal Zur Israel Synagogue in Recife) or yet in structures of powder rooms (as in the Orange Fortress in Itamaracá), certainly associated to waterproofing.
- b. Still based on the archaeological excavations performed, there were walls built after the Dutch were ousted, with small Dutch yellow bricks, used amidst other bricks with different characteristics. These were buildings where materials of older buildings were reused.

From what could be learned of the archaeological research performed, the construction of the Reis Magos Fortress was made basically in stone and chalk, with regular stones used mainly in the lining of walls and tiling of the flooring, and irregular ones used in the bulk of the construction.

The excavation of pits disclosed that the walls were erected on the sandstone of the reefs. By building on the reefs, the fortress's structure would not require high foundations. In reality foundations' height was meant to guarantee that tidal inflow and outflow would not result in the excessive humidity of the rooms. Considering the depth of the reefs in the pits, and the quota of the underlying flooring in relation to the inner walls, foundations would vary approximately 74cm.

A further investigation of construction techniques employed revealed that the first layers of the wall's foundation were built with irregular stones piled directly one on top of the other, unmortared. This construction technique used in the foundations has been seen in other constructions dated of the first quarter of the Seventeenth Century in Pernambuco. Examples of this type of construction are in the Dutch strong houses in the Fortress Orange¹ in Itamaracá and the foundations of a warehouse in the proximity of the Port of Recife².

As mentioned before, on the reefs, the stones were piled unmortared, using a programmed quota for the flooring thus forming the base, the foundation. From the foundation up the stones were interlaid with sand and chalk mortar, used to build the walls.

The foundation is of the same width of the wall with no physical marking separating foundations from walls.

The inner walls as well as the walls contiguous to the courtyard stand perpendicular to the flooring. The ones supporting the embankment are technically retaining walls.

1 ALBUQUERQUE, Marcos A. G. M; LUCENA, Veleda, 2013

2 ALBUQUERQUE, Marcos A. G. M; LUCENA, Veleda, 2000

Therefore, they hold the sand filling in the embankment space. Although this wall is not perpendicular to the flooring its inclination is minor something close to 83.9° and in the orillons barely reaching 85.4° .

As mentioned before, the original structure of the fortress, walls and barracks were built with sand and chalk mortar. The main stone used was sandstone, possibly extracted from reef slabs. This was common practice in the first years of colonization throughout the coast, intensively opposed by the authorities but apparently with no significant avail. Both the Dutch and Portuguese administrations used the resource. It was opposed to by both administrations, but intensively used, notwithstanding the resulting damage. There are two types of sandstone present: one is more friable, grayish, clearly originated from the reefs. The other, more consolidated, lighter in color, could have been extracted elsewhere. Occasionally corals are found (*cabeça-de-carneiro*, small round coral) interlaid with the stones.



Figure3–Note the foundation with unmortared juxtaposed stones.

Calciferous sandstone is the most intensively used material in the fortress' construction. Both regular whole stones and cracked irregular stones were used. Regular whole stones that would line the walls were the ones used for stonework³: ... *and the whole construction should be externally lined with stonework 15 spans high (Francisto Frias, 1618).*"

³ Silharia -obra feita de silhares ou lousas, chapas de pedra lavrada para revestir paredes. Castro, Adler Homero Fonseca de Subsídios ...Op. Cit. P 45



Figure4-Note the juxtaposition of the flooring, resulting in the quota's elevation.

Arches built in carved stones were placed at the main gate and at the courtyard entry. These were built with stones arches to sustain the powder house structure. Judging from a few remaining samples the windows and doors frames must have been made in carved stone as were the stairways giving access to the embankment.

Vaulted ceilings present at tunnels, casemates, at the access to the postern, in one of the stairways to the embankment were built with cooked argyle bricks, and grouted with sand and chalk mortar.

Other aspects investigated were the typology and altimetry quotas of the original floorings of the two pavements of the Fortress, especially of the North, East and West aisles. The foundations of the former masonry walls, suppressed in refurbishing/spatial adaptations of other periods, were searched for. As for the original flooring of the fortress, part of it was preserved throughout time, although showing signs of wear. Nevertheless, in most of the rooms and in the courtyard itself the original flooring had been removed a long time back, when for two times the whole internal quota of the fortress was raised. This alteration probably sought to solve the humidity problems caused by the very high tides.

A major part of the original flooring was removed, but there are indications of its placement. Originally the flooring had been tiled with regular cut stones (rectangular) with variable size and thickness, set with chalk mortar and grouted with the same material. Those were sandstone blocks, probably harvested at the close by reefs and cut by the use of stonework techniques. This resulted in a regular surface in spite of the wear and fissures suffered with time. In the remaining area there are places showing depressions especially in the presence of fissures. In these areas, at some point in time there has been

an attempt to level the flooring through grouting with mortar and chalk.

A very long time after (already in the Twentieth Century) with the continuation of the cracking and depressions, leveling the flooring was once more attempted by the use of grouting with Portland cement.

On the other hand, in many of the fortresses known in the coastal area, the courtyards were not always tiled. Either because they were too big, or because of their purpose, or yet because resources were scarce, a major part of the fortresses already excavated in Northeast Brazil do not have their courtyards tiled. The Rei Magos Fortress had its courtyard tiled very early in time. In this fortress, the courtyard's tiling caught the eye, between 1611-1612, of the author of "Description" who mentioned: "...when passing the third and last arch we find the Courtyard in a most beautiful setting, entirely tiled in carved stones..."⁴



Figure5-Partial view of the courtyard excavation the two phases of landfill in the pits

Confirming the statement that the original flooring was tiles in regular cut stones, remains of this flooring were located in the courtyard 91 cm deep, where part of what would have been a subfloor constructed with sand and chalk preserved the marks of the original flooring's slabs. Considering the slabs were 22 cm thick in average, the flooring would have been 69 cm under the current flooring. Still referring to the original quota, during the excavation a much worn out stone door sill was found. This sill was 40cm underground which led to conclude that the difference in levels between the courtyard and

⁴ DESCRIÇÃO do Rio Grande, s.d. (c. 1612). *apud* GALVÃO, op. cit. p. 263

the barracks was about 29 cm which is compatible with the concern of rainwater puddles in the courtyard. This was the tiling technique adopted in all the rooms preserving the original flooring: regular slabs set on a chalk and sand mortar base.

A second type of flooring was observed in the fortress. It was set with irregular stones not only in size but in thickness as well, placed and grouted with chalk mortar. These are sandstone blocks probably harvested in the nearby reefs, cut irregularly with no stonework performed. As a result, the surface is not regular in spite of the efforts of using mortar to fill in the gaps. This flooring is currently found in some of the rooms and may have suffered change in the great renovation of the sixties or even in the ones performed later.

It's important to note that two of the rooms, as suggested by iconography, were prison locations, in those rooms, the space comprised between the flooring and the sandstone of the foundation is filled not by sand, like the others, but with huge stone slabs, suggesting that they were used to avoid fleeing attempts.

More recently, certainly in renovations performed in the Twentieth Century, a rectangular brick flooring (square) measuring 18 x 18x 4cm grouted with Portland cement set on a concrete base 5 to 7 cm. thick was used. This type of flooring was part of a major renovation by IPHAN in the second half of the Twentieth Century (ca 1964) corresponds to the current flooring of seven rooms.

In addition to responding to the issues related to the restoration itself, the archaeological research performed in the Reis Magos Fortress aimed at understanding the use, logistics and warfare capacity of the fortress. Documentary analysis performed, comprising a very long timeline of the fortress's utilization, disclosed possible inconsistencies and contradictions requiring clarification. The overall aspects addressed in the archaeological research can be referred to in the final research Report⁵. This article covers some of the studies related to the structure of the Fortress, and does not contain all of the work performed, including the analysis of the mobile material retrieved. This was the subject of a separate volume of the Report⁶.

Therefore, some of the topics were selected for the article. This included logistics such as water supply considering the conditions of a stronghold surrounded by the sea, defense issues as the access to the fortress and the artillery distribution in the embankment.

THE INCONSISTENCIES EXISTING BETWEEN DESIGN GUIDELINE AND THE FORTRESS CONSTRUCTION

Historical, text and iconographic analysis when compared to the current building clearly indicated inconsistencies between the design and the actual construction. Such problems reflected on several of the structures, such as the front defense, that is, the

5 Disponível em <http://www.brasilarqueologico.com.br/relatorios.php>

6 Disponível em <http://www.brasilarqueologico.com.br/relatorios.php>

gateway, and the orillons of the gateway, the logistic apparatus involving the powder houses and water supply and the religious requirement represented by the chapel. Still in terms of the defense structures the location, distribution of artillery devices and its compatibility with the available space in the embankment, as well as in the layout of the ramparts surrounding the fortifications were analyzed. Each of these was studied based on the archaeological records revealing the changes occurred throughout time. This article briefly addresses three of these points considering the extensive discussions concerning the subject.

THE GATEWAY

The main access to a fortification, named gateway generally consists of a vaulted tunnel located beneath the main gate. It could contain *“traps, such as embrasures to allow defenders to retard enemy invasion into the fortification”*. Although such recommendations from Vellozo (1728) concerning a gateway were made after the design and construction of the Rei Magos Fortress, strategies to contain the enemy, at the time, were usually followed.

Considering the functions of containing, retarding or even repelling the enemy once they breached the main gate, the defenders of the fortress should have the means to attack before they stormed in. Therefore architectural devices were adopted: obstacles and gun powder fuses entangling and retaining the assailants in the gateway, battlements allowing for lateral fire from the barracks and gun ports, from which bombs, hand grenades and other firing devices caused havoc on enemy forces. Such devices were non-existent in the Rei Magos Fortress in its Twentieth Century version. This could be traced to the restorations that had taken place; therefore, a reason for this lack of defense system had to begin with the understanding of how the gateway defenses had been originally built.

The pits excavated in the gateway walls did not show any evidence pointing towards architectural devices used as gun ports. Nor evidence was found indicating the remains of gun powder lines.

On the other hand, a structure in the gateway's vaulted ceiling could have been one of the devices described in the construction manuals of fortifications (holes) through which “bombs”, “gunpowder fire” could be launched on the enemy if they succeeded to breach the main gate and invade the fort. That has been the oral tradition recounted by tourist guides to visitors who add “hot oil” spilt on the invaders. Especially the latter recalls a medieval image, which is not coherent with the modernity of that fortress already clearly influenced in its construction by a defense line that considered gun fire. It is also known that retardation devices against invaders from the gun ports in the gateway vaulted ceiling, remained in use in the Eighteenth Century, which is well ahead in time considering the

7 Castro op.cit. p. 99

construction date of the Rei Magos Fortress.

Currently the upper part of the constructions remains closed and has possibly been damaged, so severely, that the flooring in the embankment does not show remains of that structure which would have to be open and erected from the floor in its original form. Nevertheless, it must be considered that the existing structure in the gateway's vaulted ceiling does not follow the best form: *"These holes are made in various shapes, the best are the round ones..."* in addition they are not narrower in their lower part, as recommended by the *"Methodo Luzitano"*.

We should consider different functions that may have been assigned to that structure. The notes of the Record Keeper in the inspection performed by the Provedor Mor in April 29, 1622 described that *"inside the doors there are two iron wrought falcons weighing ninety pounds each and able to fire two straight balls a span and a half from the floor, these cannons face the mentioned bronze doors (main gate)."* The reference to the presence of cannons inside the building, firing against the main gate, in the case of invasion, raises the thought that the holes in the gateway vaulted ceiling could have worked as chimneys through which the gas resulting from the detonation of cannon balls from the ground with black powder could have passed. This hypothesis is also reinforced by the same inspection text dated from 1622 for the Provedor Mor in his careful observations related to the security of the structures (detailing the woodwork of the doors, the locks, etc) does not mention the referred to structure as a defense device. If it were a gas escape chamber it is possible it would not have been mentioned. Therefore, we may consider that the structure could have operated as a chimney through which the gases resulting from the detonation of cannon balls by the use of black powder could escape.

Another important aspect to consider in the current space involving the gateway is the accesses to the casemate and the embankment. In this configuration the only defense in case the enemy approached the wall would be the main gate. Once that was breached nothing beyond the efforts of the defenders and their weapons would detain or retard the invaders. They would have free access to the casemate and to the stairs leading to the embankment. Certainly, this more current aspect reflects an adequacy of the structure to a new function which is not that of a fortification.

Analysis of designs from different time periods suggested that modifications had been made. Could they have been the results of the reconstructions effected in 1860, when the fortification was renovated both then and in 1863, when a taillight was built on the North curtain wall?⁸

Or the design of 1866 was merely a draft of the existing structure? Could these have reflected the changes made during the First World War, when they installed the Coast Artillery, with modern weapons? One of the considered hypotheses related to the set-up

8 RELATÓRIO do presidente da província do Rio Grande do Norte. 28 de abril de 1860. p. 1 Apud Adler, HFC. Forte dos Reis Magos –Subsídios para Restauração. p. 55.

of the gateway was that the wall holding the vaulted ceiling was closed at the front, with postern offering access, turning again and running close to the garrison to turn once more in the direction of the central court. Archaeological excavation in positive quotas revealed alterations in the mortar used, at the point where there could have been a frontal closing wall and where the defense falcons were placed at the entry. Close to where the wall might have been, the flooring had been replaced in certain places by slabs that were less worn out than the rest of the gateway. Other details have given support to this hypothesis for the crowning portion of the column supporting the arch, in the location where the wall would have been, was different from the rest of the building built in carved stone, and complemented with the use of Portland cement.

The evidence collected concludes that the curtain wall had been extended to prevent direct access to the courtyard.

Resuming the Provedor Mor's information as he describes the gateway and the main gate of the fortress with its locks, he states that: *and in the inner sides of the doors are two iron wrought falcons with ninety pounds each firing two balls a span and a half from the ground, pointing towards the bronze doors*"

1. The cannons were under the vaulted ceiling of the gateway.
2. The cannons were behind the walls, aiming through open gun ports in that extension of the curtain wall.

The openings in the vaulted ceiling of the previously mentioned gateway, that could have been used to dissipate gases, could also have been used for either purpose. But, the design of the Engineer Gustavo Luiz Guilherme Dodth, 1866, as referred to above, depicts a note suggesting the possibility of the presence of two cannons.



Figure6-Circulation scheme through the gateway.

Even if the falcon cannons could have been accommodated, either in the vaulted ceiling, or in the courtyard, it is certain that the space was closed by the extension of the curtain wall, as demonstrated by the archaeological excavation.

The gateway to the Reis Magos Fortress was initially built from the main gate by a vaulted tunnel, closed at the end with a solid wall, where there probably were two openings through which the falcon cannons positioned in the barracks would fire. In the middle of the gateway a postern gave access to a second room that communicated with the barracks through a third postern.

In summary it could be considered that the current layout of the gateways is not compatible with the principles that guided the security of fortresses gateways. Certainly, throughout time in an attempt to adapt the old fortifications with modern needs, reconstructions were effected which ruled out the gateway as a security structure.

THE FORTRESS DESIGN AND ITS WAR CAPACITY – THE EMBANKMENTS

As a rule the embankments concentrate the fire power of a fortification. In the case of the Reis Magos Fortress there are two recurrent questions:

1. The distribution of the cannons in the embankment – the case of the wall facing the sea.
2. The parapet quota and its relationship with the embankment's quota in the wall facing the sea.

The archaeological analysis of the questions raised considered the comparative study of different designs representing the fortress throughout time and above all the search for material remains of the original features of the fortress, through carefully chosen excavations.

One of the recurrent concerns of those dedicated to the study of the Reis Magos Fortress as a defense structure, is the marked narrowing of the embankments in the east and west walls. There are no gun ports there and certainly they did not shoot over the parapets as confirmed by the 1616⁹ design of the beginning of the Seventeenth Century. The embankment of the area facing the sea (East) is noteworthy where the parapet is at a height where no soldier, as tall as he may have been, could view the sea's surface, except with the use of a sufficiently high battlement.

9 Livro que dá razão ao Estado do Brasil.

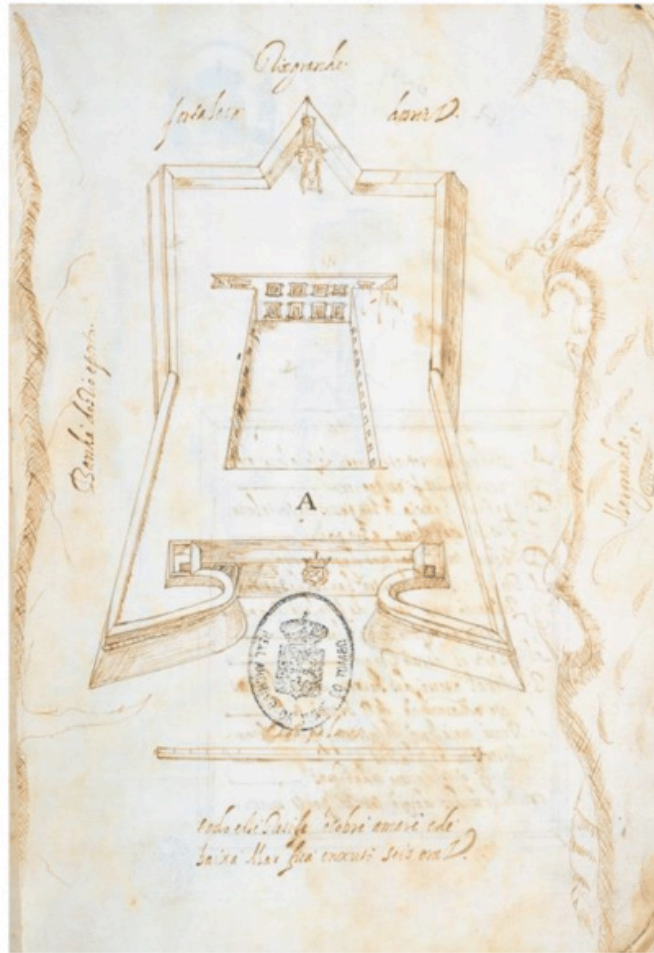


Figure7–Design where the embankment containing the barracks can be seen.Forte dos Reis Magos –1609 'RioGrande fortress of the kings. Author: unknown. Source: Original manuscript illustrating the codicil'List of Fortifications in Brazil, byDiogo de Campos Moreno present in the Archive

In addition to this, the space between the parapet and the curtain wall is very small and certainly not adequate to move back after firing recoil even with the resource of placing fine sand on its axis.

Comparative archaeological assessment of the designs, the texts and the results obtained by the excavations indicate a marked discrepancy between the design and the actual construction, resulting in the inconsistency between the embankment's size and the operation of the artillery placed there.

In the “Notes of Francisco Frias de Mesquita, Chief Engineer of this State, that the construction that remains to be made in the Rio Grande Fortress, are commissioned as you Sir, may see fit” (January, 1619) when dealing with barracks (contiguous to the embankment)

“ All houses and soldiers quarters will be vaulted for the walls are very thin, and the distances between the buildings very small and they can stand one against the other, and we will save timber which is costly and short lasting. **And through the ceiling they will be tiled. (we highlighted)** . And I should advise that the tiling will be placed by chains for the parapet area, as well as fragments of tiles on the abodes will be sustained by two brick lines placed lengthwise”.

The statement that “*the barracks will have vaulted ceilings and will be tiled*” indicates that the embankment would cover the barracks and its size would be compatible with the placement and use of cannons. This suggests that in the Frias de Mesquita’s design the embankment would be different from the current one and had not been built according to design.

The barracks will be tiled and the Capitão Mor’s house shall be built in such a way that it will descend one step over the tiled ceiling.”

The platform that I ordered to be built on the wall facing the sea shall be built as instructed because it is extremely necessary to strengthen the curtain wall therefore it shall be constructed with fifteen spans of large stones and sound foundations.”

His statement is confronted by Nuno Pimenta de Avellar:

The architect Francisco Frias in his way to Rio Grande “on your orders to oversee the construction of the fortress, stated he would provide a list of houses to be built all with vaulted ceilings and that will be excessively costly because of the dimension of the construction and impact on the materials, that will be lacking, specially chalk and brick. It should be considered that full assistance was given to architect and the construction was not really necessary to the fortress for the interior of the houses were lower than the wall itself.”

The design in the Book that agrees with the State of Brasil concerning the lack of parapets, certainly is closer to Frias de Mesquita recommendations, with the embankment covering the barracks and cannons firing from every side of the fortress. (View of the fortress in the Book that agrees with the Estado do Brasil, dated from 1616). Reis Magos fortress (Moreno-1809. Op. Quoted.)

Castro (2013) mentions this particular difference , “*This design, as well as the text attached explains that the fortress was not ready, points out some interesting points such as: first of all the fortress is shown without gun ports with cannons firing through the ‘barbeta’.*”¹⁰

A layout dated from 1609 depicts the fortress with its embankment topping the barracks, although the design shows parapets.

Still according to Castro (2013)

At that time, the first years of the Seventeenth century, the fortress was not as it should be: the Moreno report informs that it was incomplete, where the parapets began. These were nonexistent at the time; the walls were only four meters high at some points, only two thirds of what they reached when the construction was completed. More importantly, there were no filling materials in the curtain walls, no barrels or magazines, there were no ditches or cisterns...”¹¹...

These designs and the ones that followed did not show the barracks under the embankment, archaeological evaluation of the walls forming the barracks did not confirm remains indicating that in the past they were topped by a vaulted ceiling. Therefore, our conclusion is that although the original design of the embankments depicted them as

10 Castro, Adler Homero Fonseca de Subsídios. (2013)Op. Cit. P 45

11 Castro, op.cit.p 46

being sufficiently wide to house artillery firing from every direction, the alterations imposed probably during the construction narrowed the East and West embankments in such a way it made it impossible to position artillery compatible with use.

Cannons distribution, their position along the walls, when associated to parapets and gun ports, represent a relatively fixed position, which could be spotted by the enemy during a siege. This condition was noted by some of the fortification building masters, who defended the use of gabions over the barbican's parapets. But this was not the idea of Manoel de Azevedo Fortes who advocated the use of high parapets up to 10 spans, with battlements. This type of design was advocated by the builders of the Reis Magos fortress who although initially placing the cannons to shoot from the barbicans struggled to finalize the designed parapet. Cannons distribution and their position along the walls, when associated to parapets and gun ports, represent a relatively fixed position that could be spotted by the enemy during a siege.

Following the repossession to the Rio Grande's lands and the return of the Portuguese command to the fortress, there had already been a marked alteration of the East wall. There the wall had not resisted the onrush of the sea and had been partially destroyed with the loss of a considerable volume of the sand filling. The structure had been temporarily stabilized by the Dutch with repairs made with timber. In time the stone structure was rebuilt.

The Reis Magos Fortress design from 1763 does not inform the position of the gun ports. More than two centuries following the construction of the fortress, the design of the Engineer Gustavo Luiz Guilherme Dodt dated from September 1866¹² provided information related to the distribution of the gun ports in the high courtyard of the Reis Magos Fortress. Fire power was concentrated in the wall facing the bar of the Potengi River (North), and was practically disregarded in the East wall, facing the sea. In the narrow portion of the embankment, close to the reentrant angle facing the West there are gun ports.

Sometime later, the 1873 design, studied by Colonel José Joaquim de Carvalho provides information concerning the distribution of gun ports in the upper courtyard of the Reis Magos Fortress still in the second half of the Nineteenth Century. Information concerning each of the gun ports is not consistent with the information given by Dodt; nevertheless, like the previous one, it depicts practically no gun ports facing the sea, notwithstanding the considerable length of wall there, the absence of gun ports in the narrow portion of the embankment, close to the reentrant angle facing the West was noted. It is possible that the number of gun ports had been changed. It should be noted that in the last half of the Nineteenth Century there was a marked improvement in the weapons used as compared to the ones in the beginning of the century and that could have resulted in their adjustment and repositioning. In the Reis Magos Fortress, according to Castro in 2013,

12 FORTALEZA dos Santos Reis Magos, Engenheiro Gustavo Luiz Guilherme Dodt, 1866. Mss. Arquivo Histórico do Exército.

“The fortification was again repaired in 1860 and 1863... although the cannons furnished in 1863 were in a bad state. While we did not find documentation concerning this, it seems obvious that the gun ports in the northern part of the fortress were changed during the reconstruction made in the fortification system of the Empire during the Christie Incident (1863),”

But, the design of the Reis Magos Fortress from 1873, studied by the Colonel José Joaquim de Carvalho provides other information concerning the position of the defense in the embankment.

The cut (approximately W/L) in the design, when compared to the cut of the front curtain wall (S) suggests that alongside the wall facing the sea, there were no battlements, or at least they were not represented in the design, while in the south side the battlement is clearly depicted. It should be noted that the front view of the fort, in the 1873 design, the wall's inclination, in every cut, is exaggerated, and does not correspond to the actual disposition of the wall which, in fact, is almost vertical.

Our understanding is that throughout time, especially in the wall facing the sea, there were various interventions made to repair the structures in the northern side of the fortress.

More recently, already in the Twentieth Century, when the fortress was no longer considered a defense unit, and was rapidly becoming a ruin, a major part of that wall and its parapet was either completely renovated or repaired, under the administration of IPHAN. At the time maybe there were no remains of the gun ports location from the Nineteenth Century. The lack of iconographic information from the Seventeenth Century related to the positions of the gun ports added to the changes promoted in the Twentieth Century, leave us with the basic information from the Seventeenth and Nineteenth centuries although there is some disagreement concerning the two gun ports.

THE PARAPET QUOTA AND ITS RELATION TO THE EMBANKMENT QUOTA IN THE WALL FACING THE SEA

As for the East side of the embankment, another question is raised: the height of the parapet. As referred above, in that wall the parapet is so high that it wouldn't allow even the tallest soldier, to view of the sea's surface, unless a battlement compatible in height had been available, or through gun ports, if there were any. When analyzing this aspect, we should consider that along the East wall the parapet's height remains approximately at the same level, nevertheless, the relative height, that is, the different level between the flooring, where one walks and the parapet top, varies. This variation is due to the fact that the flooring is not leveled, on the contrary, along the portion between the outstanding SE angle and the outstanding NE angle there are two platforms that are more elevated in the extremities and descend as a rampart in the direction of the stairway leading to the courtyard.

The current building discloses an arrangement, an accommodation of the flooring quotas, which would have impaired visual access to the sea from that area of the wall surrounding the reentrant angle. In fact, the view of an approximation by the sea was not lost, considering that from the outstanding angles there is an ample vision of the sea throughout the coast. The issue could be resolved by the placement battlements along the parapet, but maybe that was not judged important for the purpose of positioning musketeers or harquebusiers.

We do not know for sure how old this quota accommodation is. It was probably related to the recurrent interventions in that area, caused by sea damage in that wall.

When establishing a comparison between the embankments throughout the East and West walls, it is noted that although the parapets of both sides have the same quota, the flooring quota is quite different. In the West wall, although there is a difference in level in the rampart (salient angle) and the surroundings of the reentrant angle, it is possible to look over the parapet and view the whole wall¹³, and that does not happen in the wall facing the sea.

On the other hand, the two access stairways to the upper courtyard described in the Antonio Barreiros visit in 1622, who at the time was Provedor-Mor, had the same number of steps.

“(...) and climbing up. In the direction of the High Courtyard, name O Picão by using two stone staircases, one to the right, close to the Barracks and the other to the left close to a house which is destined to become a cistern each one with twenty two stone carved steps (...)”.¹⁴

Currently, the two staircases do not have the same number of steps. They would have surely undergone repairs in almost four centuries. There have been very extensive renovations with the replacement of a major part of the steps. Nevertheless, it is probable that it would have maintained the same dimensions and arrangement, at least in the staircase accessing the West wall the number of steps remain the same.

This is an important issue because the number of steps in the staircase with access to the East wall is smaller, and results in a quota lower than the opposing staircase. On the other hand, the staircase in the W wall does not end in the limits of the curtain wall but advances the embankment some 2.06 m.

The same does not happen with the East wall, the limits of which advances 2 steps into the embankment. The advance of the staircase in the direction of the embankment is of 6 degrees which corresponds of a difference of level of approximately 1.20 m. This number of steps corresponds to the difference between the numbers of steps in each

¹³ É possível ver por cima do parapeito, mas não é confortável, ao menos para alguém de 1,60m. Para alguém da altura 1,80 seria possível ver por cima desse parapeito com mais tranquilidade.

¹⁴ *Relação das visitas que o Provedor-mor da Fazenda de Sua Majestade do Estado do Brasil fez por serviço do dito senhor nas Fortalezas da Capitania de Pernambuco e nas mais do norte e das devassas que nelas tirou do procedimento dos oficiais da fazenda, alfândega e almoxarifado delas e outras diligências no aumento da Fazenda Real do dito senhor.* In. GALVÃO, Hélio. História da Fortaleza da Barra do Rio Grande. 2ª ed., Natal: Fundação Hélio Galvão: Scriptorium Candinha Bezerra, 1999. p.256

of the staircases. It would be fair to think that the east staircase could have originally advanced in the direction of the embankment, gaining approximately 80 cm thus elevating the flooring to a level similar to the West wall.¹⁵

This staircase advance in the embankment is contained by a masonry “box” surrounding the staircase projection. Archaeological excavation performed next to the West staircase allowed for the identification of the support structure of the staircase exit in the embankment. Nevertheless, the symmetrical excavation around the east staircase exit produced different results. There were found no remains there of a per chance existing support base in the staircase exit.

If the original construction had maintained the symmetry between the two accesses and the floorings' quota in the two sides, what was the reason for the change in the East side? It should be recalled that in that side, the wall had been breached, by the sea, back in the Seventeenth Century, according to Dutch and Portuguese reports. But repairs made then would not suffice for long. Information concerning the needs to repair the walls and its foundations are frequent especially the wall facing the sea (East wall). In every cranny that was opened, part of the sand filling had been lost and the flooring collapsed. It is possible that one of these wall repairs lowered the flooring and the staircase had to be adapted.

WATER SUPPLY IN THE FORTRESS

The city of Natal /RN has a marked heterogenic rainfall pattern not only in terms of time as in terms of spatial distribution. Such rainfall pattern, although with an annual average of 1464 mm is very erratic throughout the year and in the course of time. Considering the local climatic average, it would be fair to say that there were years when rainfall was intense and years where it has been very scarce. The rainy season goes from February to August, with historical monthly averages above 110 mm. But, during drier seasons this could be extended from October to December, with total monthly averages below 40 mm.

Such rainfall pattern, although presenting an annual average of 1464 mm, is very irregular throughout the year and has been in the course of many years. Therefore, having a cistern available to supply the fortress in these conditions would not be reliable, especially in case of war or under siege. Historical reference indicates that during the initial Iberian occupation water supply was obtained from sources in the continent and water was transported in small vessels to the fortress. On the other hand, wells were common in the interior of fortifications since the very first years of colonization.

In the case of the Reis Magos Fortress, in the center of the courtyard, there is a

¹⁵ A diferença no número de degraus entre as duas escadas é quatro. Seriam os quatro degraus que, somados aos dois já avançados no terrapleno leste, completariam o nível. O desnível entre os dois terraplenos é de 75 cm. Os quatro degraus formariam algo em torno de 80cm.

structure that has been associated to a well. Nevertheless, the location of the fortress (on the reefs) raises questions on the potability of the water in the wells.

On the other hand, when Frias de Mesquita in his notes deals with the barracks, he establishes a sinkhole to be placed under the gun powder house, where there is a well.

In the Lower Courtyard there shall be two lines of bricks with four spans surrounding it and the remaining area shall be tiled, and in the middle, below the Powder House, a sinkhole will be provided and a pipeline placed under the passage of the postern to drain the waters out.^{16,17}

On the other hand, Nieuhof when dealing with the occupation of Rio Grande by the Dutch refers to a “small chapel in the middle of the courtyard and to the well found in this chapel,

“In the center of this fort, there is a small chapel, where, in 1645 or 1646 (154) the Dutch discovered a well of approximately half a foot in diameter in the opening and three feet deep, opened in the rocks through where there was fresh water that flowed when the tide was high. In the normal tide it provided 255 jars of fresh water, but, in the full moon it rendered 350, more than enough for the garrison under siege”.^{18, 19}

Judging from the dimensions noted by Neeuhof in time, the well mentioned by the Dutch, was modified. It currently is a structure internally lined with carved sandstone blocks. The well, which is 34 cm in diameter, is 90 cm deep (measured from the current quota)²⁰ where it reaches the reef. From there it is dug in the sandstone up to approximately 64 cm with a diameter of 54 cm reaching a depth of 154 cm below the current flooring under the Powder House. Therefore, the structure of the well passes through all of the layers of the landfill in the courtyard, entering the sandstone over which the fortress was built. Below the point of contact there is a fissure in the rock, to the West, through which a water moorhen with freshwater sprouts. In reality the water sprouts in every contact point with the reef, that is, at least most of the water percolates over the reef. The quality of the water, including salinity was analyzed through refractometry (Portable Refractometer Instrutherm ATC), with the result of 1 (NTP).

In comparison, the sea water analyzed, under the same conditions, provided a result of 39 (NTP).

When assessing the well described by Nieuhof, the very narrow (half a foot diameter of the well's opening) is noteworthy when considering the correspondence of 1 foot= 33 cm. Considering this measurement, the well would be approximately 16.5 cm which seems insufficient to fill the water pitchers. This could have been caused by a possible sinkhole,

16 Apud Galvão, op. Cit.p.274

17 Essa recomendação foi feita antes do primeiro lajeamento, então quando o forte estava com o primeiro aterro de areia branca. Considero a evidência mais forte da cota desse piso o local onde encontramos a argamassa, já que nos outros cortes o aterro de areia branca pode ter sido parcialmente atingido durante a remoção daquele calçamento. Nesse caso, a cota seria em torno de 92 cm abaixo do nível de referência.

18 Nieuhof, Joan Memorável ... op cit.

19 Sob a casa de pólvora encontramos vestígios de um piso 20cm abaixo do piso atual, ou seja, 61 cm abaixo do nível de referência. Este seria o piso em uso na época dos holandeses.

20 O piso atual da superfície no local do poço está 41 cm abaixo do nível de referência.

as the one Frias de Mesquita ordered to be built under the powder house to drain rainwater and wastewater from the fortress: *“built in the middle, below the Powder House, a sinkhole that through a pipeline, placed in the postern shall drain the waters out.* ²¹

When the flooring under the postern was excavated it was noted that there was no indication of a pipeline running through the landfill or the reef foundation. Nevertheless, there could have been the possibility that the piping designed had been built in a different location. Therefore, five pits were excavated next to the foundation of the Powder House on the side facing the river, and no indication of a sinkhole was found. It must be noted that a sinkhole in the center of the barracks would not have been uncommon. But not appropriate considering it would have been under the structure of the Powder House. The sand landfill (that furnished a good drainage) associated to the construction technique of the foundations (unmortared stone), helped the flow and reflux of the waters, and consequently its drainage. It is possible that Frias de Mesquita himself thought that the waters permeating the landfill were salty, so he recommended the elevation of the flooring above the level of the salty water: *“the cistern to be built in the location chosen with the necessary care requires that compression of the area from the foundation be of dully fragmented stone until the salty water is surpassed and this must be followed by building a foundation of stone, chalk and mortar...”*²²

During the occupation of the Dutch, and not knowing its source, the water was tasted, and it was fresh water. It is possible that the structure had been in disuse, even obstructed, for there had been twelve years since the Dutch had been established when they discovered the “well”.

Going back to the issue of the well described by Nieuhoff there is a question to be considered. He describes a well with 3 feet of diameter (99 cm) in its lower portion, already excavated in the stone. Because the stone had been excavated, that would be the minimum measurement that the lower part of the well could currently present, and that is not true. Today in the reefs there is an excavation of approximately 54 cm of diameter. It is possible that there has been a mistake in the measurement made at the time.

In reality historical information related to the elevation of the level of fresh water in the well and tidal flow, was proven to be true and was confirmed by the research.

Hour	Water Levels in the well	Tidal flow	Tidal level
13:26	25 cm	High Tide	210 cm
14:30	22 cm	Lowering	181,66 cm
15:30	18 cm	Lowering	153,32 cm
16:30	8 cm	Lowering	124,98 cm

21 Apud Galvão, op. Cit.,p.274

22 Galvão, Op. Cit. P. 274

It is known that there really exists, the availability of “fresh water” in the interior of the fortress, which can be accessed through the well excavated under the vaulted structure located in the center of the barracks. This availability is restricted to high tide and happens not only in the sygyal tides as well as in quadrature tides. The volume of water obtainable, measured in the Seventeenth century was, according to Nieuhof “more than sufficient for the consumption of the garrison during a siege”²³.

Dynamics of fresh water in the well - schmatics

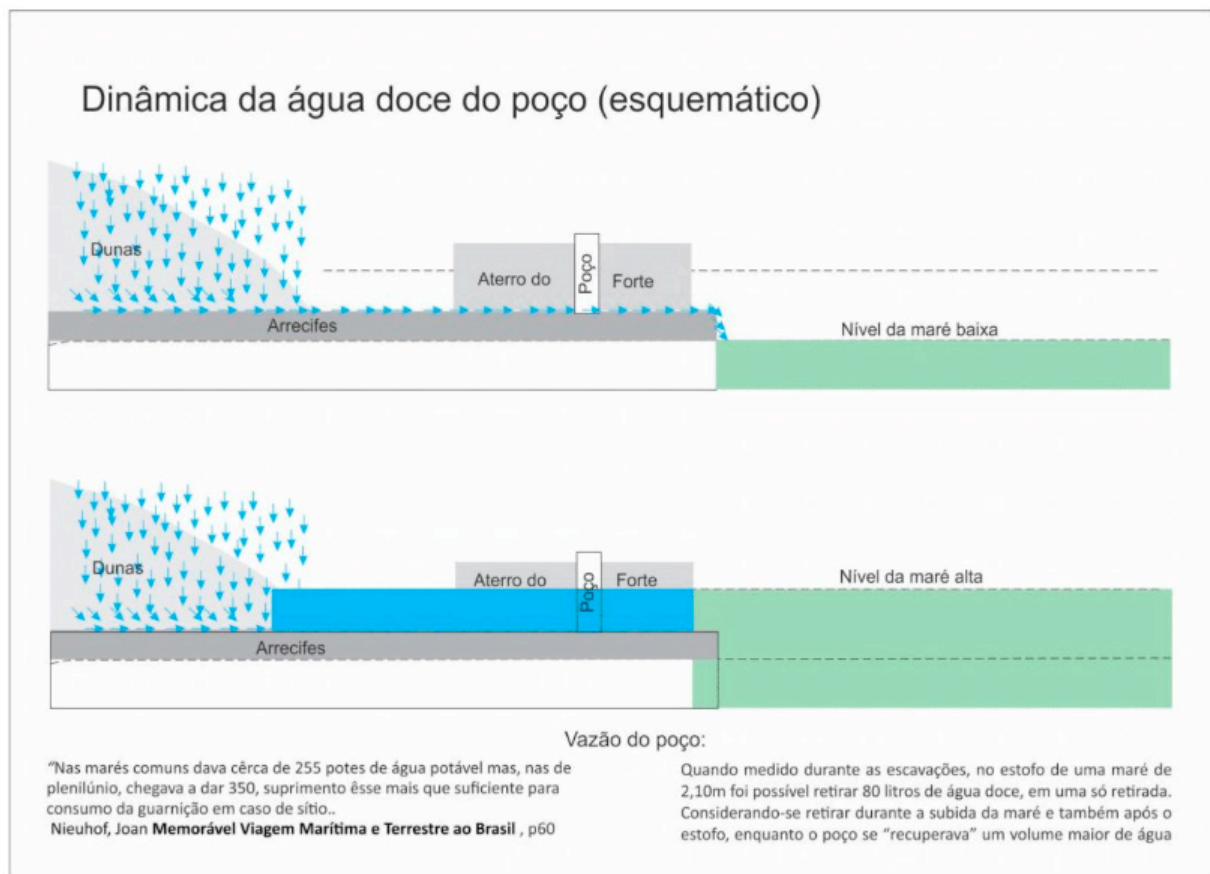


Figure8-Scheme of the dynamics of fresh water catchment in the well.

When measured through the excavations during neap tide at 2.10 m it was possible to retrieve 80 liters of fresh water at a time. Considering the removal during high tide and following neap tide, when the well “recuperated” a larger water volume could be removed, and 240 liters could be had in a tidal cycle.

Through a geoarchaeology assessment the source of fresh water could be attributed to the continental water table formed under the dunes, which in part infiltrated in the porous sandstone and in part glided over it. During high tide the fresh water free flow elevates the water level in the well. When the tide is low, again the fresh water flows free thus reducing its level in the well.

²³ Nas marés comuns dava cêrca de 255 potes de água potável mas, nas de plenilúnio, chegava a dar 350, suprimento êsse mais que suficiente para consumo da guarnição em caso de sítio. Nieuhof. Op cit, p60.

Based on the discussions above, it is our understanding that getting to know the terrain since the very beginning, including the reefs that were the foundation of the Reis Magos Fortress, the Brazilians descendants of the Portuguese thought that the water permeating their foundations would be the same salty water covering the reefs during high tide. They were not aware that the fresh water flowing from the sands of the dunes' reserves and under the fortress structure would be caught by the high tide waters. Quite the contrary, they thought of the well as a sinkhole for rainwater.

The Dutch, finding what they thought to be an old Portuguese well, after approximately 11 years of occupation, tasted the water and considered it fit to drink. A precious gift, considering the conditions. According to Nieuhof the Dutch had reformed the old sinkhole fitting it with more compatible dimensions for a well that was supposed to collect water.

Afterwards, during a renovation of the flooring, its quota was elevated; a device covered the well maintaining access availability which was grooved to enable the placement of a lid.

When the fortress was repossessed it is possible that the Portuguese resumed its use as a water source. Nevertheless, in the collective unconscious remained the idea that, in the very least the water was brackish, according to the information of historians retransmitted by tourists' guides, without anyone actually tasting the water.

FINAL CONSIDERATIONS

The complexity of the archaeological excavation in the Reis Magos Fortress disclosed the results that based its restoration, and added significant scientific information concerning its occupation throughout the centuries. It would be impossible to summarize all of the results obtained, including their respective graphic and photographic proof, due to the size restriction required of the work. That is the reason why we offer a link enabling access to the complete report of this research.

When this archaeological research was accomplished strategic and logistic aspects were considered related to the fortress' location, not only from a military view but from a landscape archaeology view as well. The assessment covered raw materials available and construction aspects from the perspective of the quality of the labor used during the existence of the fortress.

In addition to the aspects mentioned above significant alterations in the operational structure of the fortress were identified compromising its military use. All of the elements retrieved by Archaeology will offer a scientifically based restoration revealing a significant part of non recorded History of this monument so closely related to the expansion to the North of the territory of today's Brazil

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